l) that Resolution 528 invites the BR to conduct the necessary studies prior to the next (appropriate) World Radio Conference (WRC);

m) that methods and techniques for effective coordination need to be established;

[n) that Recommendation 8/xxx provides information with respect to coordination trigger levels and coordination techniques for the aeronautical-mobile telemetry service;]

[o) that Recommendation 10-11S/xxx provides similar information with respect to the broadcasting-satellite service (sound),]

recommends

1 that for a geostationary satellite operating in the 1 452 - 1 492 MHz broadcasting-satellite service (sound) band visible to any aeronautical telemetry receiving station, the coordination trigger levels correspond to a power-flux density at the telemetry receiving station in any 4 kHz band for all methods of modulation of:

$$\left[\begin{array}{ll} -186.1 & \text{dB(W/m}^2\text{) for } 0 \leq \alpha \leq 3.4° \\ -198.4 + 23.1 \log\alpha & \text{dB(W/m}^2\text{) for } 3.4° < \alpha \leq 20° \\ -182.0 + 10.5 \log\alpha & \text{dB(W/m}^2\text{) for } 20° < \alpha \leq 30° \\ -182.0 + 10.5 \log\alpha + 10 \log [1 + 0.066(\alpha - 30)] & \text{dB(W/m}^2\text{) for } 30° < \alpha \leq 62.5° \\ -157.1 + 20 \log (\sin\alpha) & \text{dB(W/m}^2\text{) for } 62.5° < \alpha \leq 90° \end{array}\right]$$

where α is the angle of arrival (degrees above the horizon);

2 that the coordination trigger level for interference from transmitting aircraft in the aeronautical-mobile telemetry service to broadcasting-satellite (sound) receivers corresponds to a distance of [500 km];

3 that the power-flux density at the surface of the Earth from a geostationary satellite in the broadcasting-satellite service (sound) band shall not exceed [dBW/m^2/4 kHz];

4 that the e.i.r.p. density from an aircraft in the aeronautical-mobile telemetry service shall not exceed [dBW/4 kHz];

5 that the satellite antenna discrimination outside the coverage area should be as great as possible, but as a minimum should conform to:

- for simple beam patterns [Appendix 30];
- for multiple/shaped beam patterns [Recommendation ...];

6 that, where practicable, the main lobe of the telemetry receiving antenna should avoid being directed at the satellite;

7 that, where practicable, carrier frequency avoidance should be used,

[**decides**

that co-frequency, co-coverage operation of broadcasting-satellite (sound) systems and aeronautical-mobile telemetry systems in the 1 452 - 1 492 MHz band not feasible.]

Documents
Radiocommunications
Study Groups

USTG 8-3/14(Rev.1)
USTG 2-2/4
16 June 1994
Original: English

United States of America

AERONAUTICAL MOBILE TELEMETRY SYSTEMS SHARING WITH THE MOBILE-SATELLITE SERVICE AND THE BROADCASTING SATELLITE SERVICE(SOUND) IN THE BAND (1452-1525)MHz

(Resolutions 528, 46 and WARC-92)
(Question 62/8)

1.0 INTRODUCTION

Document 8B/TEMP/26(Rev.1),2 November 1993, contains a Preliminary Draft New Recommendation proposing coordination threshold values in terms of Power Flux Densities (PRF)'s for the protection of aeronautical mobile telemetry systems in the band 1452-1525 MHz along with potential techniques which may be useful in coordination. Both Geostationary and non-Geostationary (limited to low altitude circular orbits) satellite networks were considered. Document 8D/128 is a liaison statement forwording Document 8B/TEMP/26(Rev.1) to WP8D. Document 8D/TEMP/119 is a response to WP8B in which it is noted that a difficult sharing situation exists between aeronatical mobile telemetry systems and the Mobile-Satellite service.

Document 2-2/TEMP/4(Rev.1),3 February 1994, addresses the sharing situation between aeronautical mobile telemetry systems and the Broadcasting Satellite (Sound) service. It contains a Framework for a New Recommendation based on Document 8B/TEMP/26(Rev.1) and also indicates that co-frequency, cocoverage operation does not appear to be feasible. WP8B is requested to review the results given in Document 8B/TEMP/26(Rev.1) with the view of increasing the coordination trigger levels and increasing the feasibility of co-frequency, non-cocoverage sharing. It is also noted that only Geostationary or possibly highly elliptical orbits are being considered for the Broadcasting Satellite (Sound) service. Additionally it also appears that only Geostationary orbits are being considered for the Mobile Satellite service in Region 2 at this time. In accordance with the request by TG 2-2 to review the results given in Document 8B/TEMP/26(Rev.1), there are some areas where modifications to some of the parameter values are possible.

2.0 GENERAL CONSIDERATIONS

Document 8B/TEMP/26(Rev.1) includes the band 1452-1525 MHz,i.e., the results apply to both the Broadcasting Satellite (Sound) service and the Mobile Satellite service. The document addresses both low earth orbits and Geostationary orbits. Since

ATTACHMENT D

there is no current interest in low Earth orbits for these services in this band, only Geostationary orbits are being considered herein. It is noted that work being accomplished in TG 4-5 could be applicable in refining the analyses with respect to systems using non-Geostationary orbits.

3.0 CANDIDATE PARAMETER MODIFICATIONS

In general, the parameter values which may be reviewed are those defined by probability functions.

The most significant parameter which may be modified is the sidelobe and backlobe gains of the telemetry antenna. The present envelope is based on "peak" gain values. Because of the motion of the aircraft the probability of the peak gain is very small. It would appear reasonable to use an average or a 50% probability gain in the sidelobe and backlobe regions. A somewhat lower peak envelope gain might be use for the 29dB antenna. Modification of the antenna gain envelope patterns modifies the gain probability function, which in turn modifies the interference statistics. This would not affect the low elevation angle values of PFD but would increase the values at higher elevation angles.

It is noted that the analyses start with two antenna gain functions which eventually results is a composite PFD function. Additionally, actual antenna gains vary from 26dB to 41dB so that a composite envelope gain function can be used for the initial function. As shown in the document the particular antenna gain at a telemetry site can be accounted for in the PFD functions.

Another parameter which may be reviewed is the desired carrier level probability function. A small modification of the cumulative distribution function might be possible which would allow a small increase in the PFD values.

The joint cumulative distribution function needs to be computed for any modification of the above two parameters in order to determine the effect on the coordination criteria given in Document 8B/TEMP/26(Rev.1).

The model used for the satellite population in the Geostationary orbit may also be reviewed. Modification of the model would effect the higher elevation angle PFD values.

4.0 SUMMARY

Section 3.0 indicates where potential modification of certain parameter values given in Document 8B/TEMP/26(Rev.1) may be made. A review and subsequent analysis is planned to be completed in time for submission to the the appropriate Task Groups and Working Parties at their meetings in the Fall of 1994.

Documents
Radiocommunications
Study Groups

USTG 8-3/33(Rev.1)
USTG 2-2/3
16 June 1994
Original: English

United States of America

POWER FLUX DENSITY AT THE EARTH'S SURFACE FROM AIRCRAFT TELEMETRY EMISSIONS IN THE BAND 1452-1525 MHz

(Resolutions 528,46 and WARC-92)

1.0 INTRODUCTION

Document 8B/TEMP/26(Rev.1) addresses the sharing situation between aeronautical mobile telemetry systems and the Mobile Satellite and Broadcasting Satellite (Sound) services with respect to the protection needed for the aeronautical mobile telemetry systems. The information contained in that document can also be used to estimate worst case power flux densities (PFD)'s at the surface of the Earth from aircraft telemetry emissions. Comparison of these PFD's with those required for receiving stations in the MSS and BSS(S) services provides a measure of the sharing difficulties when the aircraft is visible to the receiving stations.

2.0 PFD COMPUTATION

The aircraft transmitter power varies from 3dBW (2 Watts) to 14dBW (25 Watts) depending on individual test requirements,e.g., maximum range, carrier bandwidth, receiving station antenna gain, availibility, etc. The aircraft antenna gain is defined by a probability function. For purposes herein this gain is associated with a probability. The gain value which will not be exceeded 99% of time is 0.5dB. This is based on a FSK modulation in which the carrier power is assumed to be uniformly spread over 400kHz with a probability of 0.5. A free space spreading loss is assumed using the slant range from the aircraft to the Earth's surface. A aircraft altitude of 20Km is used along with the true Earth's radius. The PFD in dBW/m^2/4kHz is computed using the preceding parameters as a function of the angle of arrival and surface distance from the aircraft. These functions are shown in Figure 1 for both a 14dBW and a 3dBW transmitter power. For 95% of the time the values would be 2.3dB lower. It is also noted that the geometric line of site distance is about 500Km, a value commonly used for the coordination distance from an aircraft to the Earth's surface.

Where the maximum distance from the telemetry receiving site to the aircraft is much less than 320Km, the PFD's would be lower than indicated in Figure 1, but this is not true in all cases. The distance from the telemetry receiving station to locations where MSS or BSS(S) receiving station are located depends on the

ATTACHMENT E

aircraft location with respect to these receiving stations. The maximum distance between the aircraft and its receiving station is 320Km.

3.0 COMPARISION WITH MSS AND BSS(S) REQUIRED PFD'S

A range of PFD's between -136 to $-127dBW/m^2/4kHz$ have been indicated for BSS(S) systems and for MSS systems using handheld receivers the PFD's required are similar. The values shown in Figure 1 are comparable or even higher than these required values. Thus the interference to MSS AND BSS(S) receivers can be very severe when they are in view of an aircraft transmitting telemetry signals.

4.0 SUMMARY

In Document 2-2/TEMP/4(Rev.1),3 February 1994, which addresses interference from BSS(S) Geostationary satellites to aeronautical mobile telemetry stations, it is indicated that co-frequency, co-coverage operation does not appear feasible. From the preceding analysis, which addresses interference from aircraft telemetry emissions to BSS(S) and MSS receiving Earth stations, co-frequency, co-coverage operation does not appear feasible. Co-coverage in this case refers to the line of sight area around the aircraft.

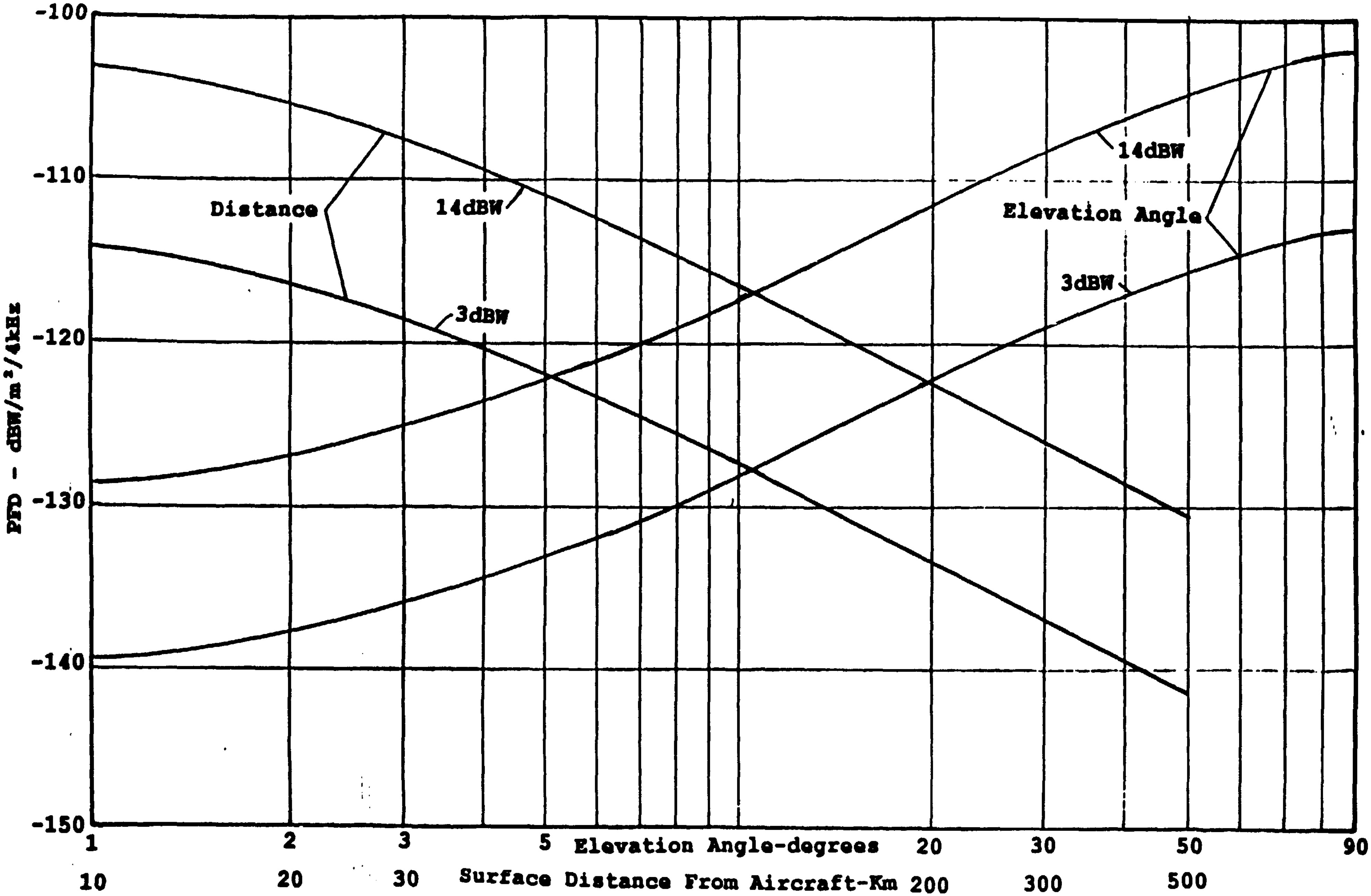

FIGURE 1 -PFD FROM AIRCRAFT TELEMETRY EMISSIONS